CHAPTER 6

TACTICAL PETROLEUM TERMINAL

Section I. Concept and Primary Components

Today's highly mobile military forces require a fuel supply system that is easily set up and flexible. The fuel supply system must be able to hold large quantities of fuel. The older steel, welded pipelines have been replaced with the new lightweight aluminum, quick-coupled IPDS. The new system for fuel storage now being used with the IPDS is the TPT as shown in Figure 6-1, page 6-3. The TPT replaces bolted and welded steel bulk fuel tanks with lightweight collapsible fabric tanks in various capacities. These new tanks can be transported with minimal transportation assets compared to the steel tanks of the past. They can be installed in a fraction of the time of the older system. The TPT is a facility designed and packaged for rapid erection at almost any location for the receipt, storage, and dispensing of liquid fuels. Fuels can be received into the TPT from the pipeline, tank vehicles, or railcars. The TPT can dispense fuel into tank trucks, 500-gallon collapsible drums, or return fuel to the pipeline for downstream distribution. The facility can be disassembled and moved to another location or returned to an equipment storage facility. The TPT can be used as the base terminal receiving fuel from ship-to-shore operations for distribution forward through the pipeline. It can also be used as the head terminal at the end of the IPDS for fuel storage and further distribution forward by tank vehicle and hoseline to nearby airfields.

PRIMARY COMPONENTS

The standard TPT is modular with three identical Fuel Units. A standard TPT is shown in Figure 6-2, page 6-4. The total TPT is stored in 77 twenty foot ISO containers. A pipeline connection assembly will be issued when the TPT is to be connected to a pipeline. The primary components are discussed below.

FUEL UNIT

Each fuel unit consists of three Tank Farm Assemblies, with two 210,000-gallon collapsible fabric tanks each, a Tanker-Truck Receipt Manifold, a Fuel Dispensing Assembly, a Transfer Hoseline Assembly, six Fire Suppression Assemblies, an Optional Tank Configuration and a Fuel Unit Support Assembly. A total of 24 ISO containers are used to store one Fuel Unit.

- Tank Farm Assembly. The Tank Farm Assembly consists of two 210,000-gallon collapsible fabric tanks, a hoseline pump and associated hose, valves, and fittings.

- Tanker-Truck Receipt Manifold. The tanker-Truck Receipt manifold consists of a hoseline pump and associated equipment to provide four receiving stations. It is used to receive fuel from commercial or military tanker-trucks.

- Fuel Dispensing Assembly. Dispenses fuel directly to bulk fuel tank trucks and 500-gallon, collapsible drums.

- Transfer Hoseline Assembly. There are fifteen 500-foot hoses (7,500-feet) with ends flaked in three tricons. Each tricon also has coupling clamps and tools for connecting the hoses.

- Fire Suppression Assembly. The main component is the Wheeled Mounted Fire Extinguisher. Skid mounted on a two wheeled trailer, the system is designed to apply the dry chemical (Purple K) until the fire is under control and then apply the aqueous film forming foam (AFFF) creating a blanket effect.

- Optional Tank Configuration. Each fuel unit has two 50,000-gallon collapsible fabric tanks with a transfer pump (350-GPM) that can be used for additional storage.

- Fuel Unit Support Assembly. This assembly consists of the fuel unit's ISIL, two floodlight sets, a hoseline installation and repair assembly, a displacement and evacuation kit, a hoseline suspension kit and a spare hoseline pump.

PIPELINE CONNECTION ASSEMBLY

The pipeline connection assembly is required if fuel is to be received or issued to the pipeline. It consists of the following major components.

- Switching Manifold. Allows the TPT to be connected to the pipeline and controls the flow in, out, and within the TPT.

- Contaminated Fuel Module. Consists of two 50,000-gallon collapsible fabric tanks to hold contaminated fuel for blending or disposal.

- Transfer Hoseline Assembly. There are fifteen 500-foot hoses (7,500 feet) with ends flaked in three tricons. Each tricon also has coupling clamps and tools for connecting the hoses.

- Pipeline Connection Support Assembly. Contains additional ISIL items, Aviation Fuels Contamination Test Kit, Hoseline Suspension Kit, Displacement and Evacuation Kit, Hoseline Installation and Repair Assembly, and a Fire Suppression Assembly.

.

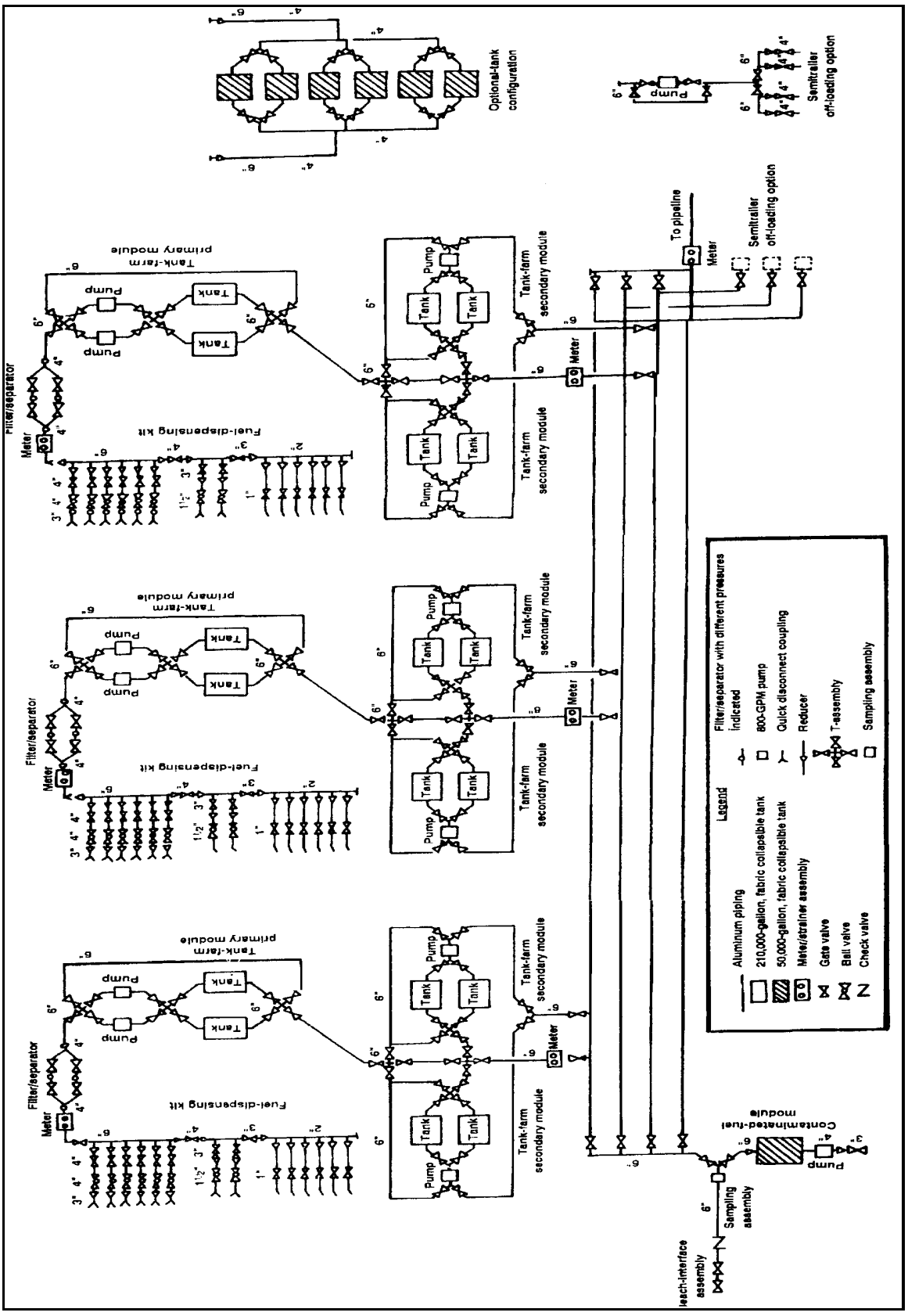

Figure 6-1. Tactical petroleum terminal

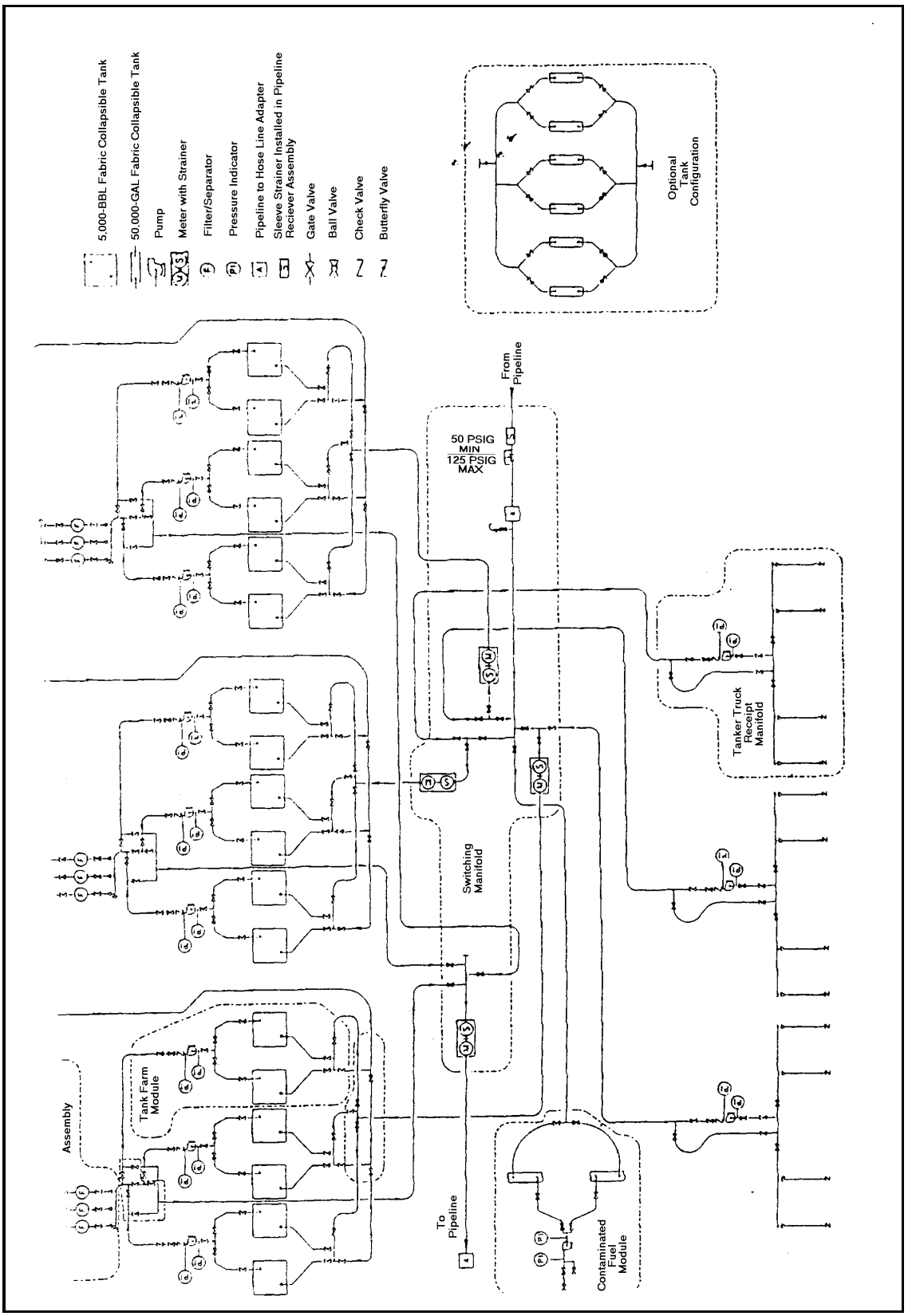

Figure 6-2. Standard tactical petroleum terminal

Section II. System Components

THE 210,000-GALLON FABRIC COLLAPSIBLE TANKS

The 210,000-gallon capacity, fabric collapsible, fuel storage tanks also known as BFTA are complete with fittings, accessories, and emergency repair items. The BFTA as shown in Figure 6-3, page 6-9. For more information on the 5,000 barrel tank see Chapter 22.

THE 50,000-GALLON FABRIC COLLAPSIBLE TANKS

The eight 50,000-gallon fabric collapsible tanks furnished with the TPT are complete with fittings, accessories, and emergency repair items. The 50,000-gallon fabric collapsible tank is shown in Figure 6-4, page 6-10. For more information on the 50,000-gallon tank, see Chapter 22.

THE 600-GPM HOSELINE PUMPS

The 600-GPM hoseline pumps are wheel-mounted, diesel engine-driven, self-priming, air-cooled, centrifugal units. The pump is close-coupled to a turbo-charged diesel engine which can be operated manually or automatically through an electric governor. Controls regulating either mode of engine operation are contained in the control panel mounted directly over the pump. The pump and engine are mounted on a two-wheel trailer assembly with internal towing bar and leveling supports. The 600-GPM hoseline pump has a discharge head of 350 feet and is rated at 2400 RPM. The 600-GPM hoseline pump is designed to--

- transfer fuel from one tank to another
- pump fuel to the dispensing set
- pump fuel to the associated pipeline or hoseline system
- pump fuels from the tank vehicle receipt manifold to the TPT storage tanks.

THE 350-GPM TRANSFER PUMP

The 350-GPM transfer pump can be field transported with a tow vehicle for short distances. A long distance move has to be made with a transport vehicle. This pump unit is used in the contaminated fuel module with the TPT. The pump can also be easily moved and used as required in other locations and services. Figure 6-5, page 6-10**,** shows a 350-GPM pump. For more information on the 350-GPM pump see Chapter 20.

METER/STRAINER ASSEMBLY

The four meter/strainer assemblies are aluminum single-case, positive displacement meters with 6-inch double-groove connections. A meter/strainer assembly is shown in Figure 6-6, page 6-11. The maximum working pressure is 150 PSI. The maximum flow rate is 800 GPM. A large numeral reset counter mounted on the meter reads out in U.S. gallons. A 0 to 1500 GPM flow indicator is included as an integral part of the assembly. The strainers included in the skid-mounted assembly upstream of each meter have 6-inch cast steel strainers with 40-mesh stainless steel baskets with 6-inch double-groove connections. The strainers have a 150-PSI working pressure. An air release head is mounted on the strainer. The meters and strainers are mounted together on a skid for easy handling and a firm setting. Three of the four meters measure fuel into the fuel units. The other meter is supplied for installation in the hoseline return to the pipeline or to a user facility. The strainers are to protect the meter assemblies.

FILTER-SEPARATORS

There are twelve 350-GPM filter/separators in the system. The filter/separator is shown in Figure 6-7, page 6-11. For more information on the 350-GPM filter/separator see Chapter 21.

PRESSURE-REGULATING VALVE ASSEMBLY

There is one pressure-regulating valve assembly in the TPT. It consists of a steel skid-mounted, 7-inch pilot-operated, pressure-regulating valve. The valve is controlled so that it will not open unless the upstream pressure is 50 PSI or above. Downstream pressure is limited to a maximum of 125 PSI. The pressure-regulating valve assembly has a 7-inch flange to 6-inch IPDS single-groove adapters on each side. Pressure gages are installed in the control manifolding to show pressures on both the upstream and downstream sides of the valve. To protect the pressure-regulating valve from debris in the pipeline, a sleeve strainer is supplied to insert into the scraper receiver at the end of the pipeline supplying fuel to the TPT. The pressure-regulating valve limits pressure into the TPT switching manifold to below 125 PSI and maintains a pipeline pressure of 50 PSI or above in operation and 50 PSI on shutdown. The pressure-regulating valves are supplied as part of the switching manifold supply.

THE 6-INCH PRESSURE CONTROL VALVE ASSEMBLY

There are three 6-inch pressure control valve assemblies in the TPT. These pressure control valves are back pressure relief/back pressure regulators set at 30 PSI. The unit is skid-mounted and fitted with double-groove adapters. These back pressure controllers are installed in the recirculating hoselines from the fuel-dispensing assembly back to the tankage to maintain dispensing pressure at a maximum of 30 PSI. These control valves are supplied as part of the dispensing assembly.

THE 1 1/2-INCH PRESSURE CONTROL VALVE

There are six 1 1/2-inch pressure control valves in the system, each set at 5 PSI. The end fittings are 1 1/2-inch with cam-lock couplings. These valves are part of the two 1 1/2- inch dispensing points at each dispensing assembly, designated primarily for filling nonvented 500-gallon collapsible drums. They limit the loading pressure of the drums to 5 PSI. The valves are supplied as part of the dispensing assembly.

FUEL SAMPLING ASSEMBLY

There is one fuel sampling assembly in the TPT as shown in Figure 6-8, page 6-12. It consists of a pipe section with double-groove ends, a 1/2-inch tap into the line, a 1/2-inch ball valve, a 1/2-inch needle valve, a goose-neck spigot, and a catch basin. A set of hydrometers is supplied with the fuel sampling assembly. This assembly is located on the inlet line to the switching manifold for each TPT to permit periodic sampling and quality control.

RANGE POLES

The TPT is supplied with 36 range poles Range poles are used to roughly estimate the quantity of fuel in the fabric collapsible tanks in the TPT. Each pole is made of two sections of steel tubing of nominal 1 1/8-inch outside diameter and of nominal 0.032-inch wall thickness. The pole is 6½ feet long with a hardened steel point permanently fastened to the lower end. The two pole sections are locked together with a spring catch. Both sections are fitted in a two-pocket cotton duck carrying case. Two poles are supplied for each BFTA. They are driven in the berms on opposite sides of the tank and a cord is stretched across the tank. The cord should be set at 6 feet 8 inches up from the base of the tank, which is the full level. Attaching a readily visible object, such as a ball, to the cord over the center of the tank makes estimating tank height easier.

NESTABLE CULVERTS

Nestable culverts are 12-inch corrugated culvert pipe. Hose can be routed through these nestable culverts for protection from traffic weight and any other effects which might cause hose damage. Nestable

culverts can also be used to protect the hose from rock or from ballast and cinders under a railway spur. The culverts are part of the TPT support assembly.

FLOODLIGHT SETS

There are six floodlight sets in the TPT. A floodlight set is a wheel-mounted diesel engine-driven generator with an integrally mounted telescoping tower carrying four high intensity lamps. One set can light 7.5 acres. It has a generator set that is powered by a 7-cycle, air-cooled, multifuel engine. It carries a fuel capacity for 18 hours. The setup locations for the six sets are determined by the requirements for the particular TPT site. Particular attention should be given to the lighting of fuel-dispensing areas, fuel receipt areas, and heavy operating areas around the pumps and the switching manifold. There is one portable petroleum aviation fuel contamination kit supplied with the TPT.

FIRE-SUPPRESSION EQUIPMENT

Each TPT is furnished with 19 sets of fire-suppression equipment. Each set contains a skid-mounted dry chemical and AFFF fire extinguisher with a remote wheel-mounted hose cart; Purple K dry chemicals; liquid foam; Kevlar hoods, gloves, coats, boots and trousers. The particular TPT layout determines where fire-suppression equipment is placed. Whatever locations are selected, they should be readily accessible to the operators and the fire suppression crew and. These locations should be clearly flagged with prominent signs. Clothing should be stored in a dry, readily accessible building or container.

HOSE, FITTINGS, AND VALVE ASSEMBLIES

For the most part, the hose, fittings, and valves are used to interconnect the equipment described in Table 6-1, pages 6-33 and 6-34, and Table 6-2, page 6-35. They are preassembled into convenient units that make installation more efficient. There are 12 of these assemblies in the TPT system.

STORAGE AND TRANSFER SYSTEMS

The equipment described previously in this section make up the storage and transfer systems described below. Installation of these components is covered in Section III of this chapter.

Tank Farm Units

The tank farm units are the primary storage units for fuel in the TPT. Fuel is pumped directly to the fuel-dispensing assembly from the storage tanks of any tank farm unit assembly. Fuel can be pumped from the tank farm unit assembly to another tank farm assembly in the fuel unit or to an associated pipeline or hoseline system if required in the particular operating area. A tank farm unit consists of two BFTAs, one 600-GPM hoseline pump, three 6-inch aluminum Ts, seven 6-inch gate valves, coupling adapters, and enough 6-inch hose assemblies (suction and discharge) to connect the components. Range poles are provided to estimate the amount of fuel in the collapsible tanks. The maximum distances in the fuel tank spacing is depends on the available hoseline and the minimum distances by safety considerations. The hoseline arrangements shown are examples. Other arrangements may be more suitable for certain situations.

Contaminated Fuel Unit

The contaminated fuel unit is used to store fuel that has become mixed or contaminated during transport to the TPT. This includes the interface which occurs in the pipeline batching and the fuel/water interface at the time of the initial purge and fill operation. Tank vehicle connections are provided so the contaminated product can be transported for blending or disposal. The contaminated fuel unit consists of two 50,000-gallon fabric collapsible tanks, a 6-inch aluminum T, a 350-GPM pump, a 3-inch ball valve assembly for loading tank vehicles, two 6-inch aluminum gate valve assemblies, and hoses and fittings to connect the components. Road access is required to allow the unloading of the 50,000-gallon tanks with tank vehicles.

Transfer Hoseline Assemblies

Three transfer hoseline assemblies are provided with the TPT. Each assembly provides the connection between the switching manifold, the tank farm units, and the return manifold to the pipeline system. Valve assemblies in the transfer hoseline allow the switching of fuel between the tank farm assemblies. Each transfer hoseline assembly has about--

- 23,000 feet of 6-inch lightweight collapsible discharge hoseline,
- eleven 6-inch double-groove aluminum Ts,
- eleven 6-inch aluminum gate valve assemblies,
- one 6-inch hoseline suspension kit,
- 16 flaking box assemblies,
- one displacement and evacuation kit,
- three 6-inch double-groove coupling clamp sets.

The hoseline is provided in flaking boxes with two 250-foot lengths per box. Four flaking boxes can be stacked on the bed of a 5-ton cargo truck and flaked out continuously.

Fuel-dispensing Assemblies

Three fuel-dispensing assemblies come with each TPT. The fuel-dispensing assembly is used to issue fuels from a TPT. There is one fuel-dispensing assembly for each of the three fuel units. Using a tank farm unit as its pumping source and bulk holding point, the fuel-dispensing assembly allows fuel loading to tanker trucks and 500-gallon collapsible drums. The major components of the fuel-dispensing assembly include three 350-GPM filter/separators, three probe adapters for the portable fuel contamination testing kit, six loading points for loading tank trucks, and two 500-gallon collapsible drum loading points. About 900 feet of hoseline and valves of various sizes are used to connect the components of the dispensing assembly.

Tank Vehicle Receipt Manifold

The three tank vehicle receipt manifolds provide the TPT with the valves, hoselines, and fittings necessary to allow the offloading of petroleum products from tank vehicles if required. A bypass line around the pump is provided, allowing the manifold to be used to load tank vehicles to supplement the fuel-dispensing set, if required. Depending on system requirements, the manifold can be installed fully or partially. Each of the manifolds has four tank vehicle unloading stations using 7-inch butterfly valves with 3-inch quick-disconnect couplings. A 600-GPM hoseline pump from the TPT support assembly is used with each manifold. The truck unloading valves are connected to 7-inch suction hose which is connected to a 6-inch suction hose leading to the pump. The bypass around the pump is made up of 6-inch discharge hose. Three 6-inch aluminum T assemblies and four 6- x 6- by 7-inch aluminum Ts provide the necessary connection for the manifold. To connect the receipt manifold to the TPT and maintain a safe separation between the components, 250-foot long 6-inch hoseline sections from the transfer hoseline kit can be used as needed.

Switching Manifold

The switching manifold controls the flow from the associated pipeline to the tank farm units and the contaminated fuel unit. It also controls the flow from the tank farm units to a pipeline or a user facility. The manifold is made up of two parts; the receipt manifold and the return manifold. The receipt manifold receives fuel from the associated pipeline and tank vehicle receipt manifold and distributes the fuel to the

tank farm unit. The valves in the switching manifold allows cuts between batches of different fuels arriving at the TPT from the associated pipeline, and, if necessary, from the tank vehicle receipt manifolds. The interface goes to the contaminated fuel unit. The return manifold receives fuel from the tank farm units and directs it to the associated pipeline or hoseline user facility. The switching manifold consists of--

- Five units of 6-inch, 50-foot discharge hose,
- 50 double-groove coupling clamps,
- Six 6-inch aluminum gate valve assemblies,
- Nine 6-inch aluminum double-groove tees,
- Four meter skid assemblies,
- One pressure regulating valve assembly,
- One sampling assembly,
- Six 6-inch single-groove to double-groove adapters.

Only two of the 6-inch single-groove to double-groove adapters are used in the switching manifold, one in the receipt manifold and the other in the return manifold. The other adapters are available for use in modifications that may be required in certain operating areas. Ideally, the switching manifold should be as compact as possible; however, certain situations may require extra length. The switching manifold setup may vary with site conditions and service requirements.

Optional Tank Configuration

The optional tank configuration can be used to replace or supplement the normal BFT's in the tank farm units or provide for special storage as required. There is one optional tank configuration supplied with each TPT. Each tank configuration contains up to six BFTAs, six 7-inch aluminum Y-assemblies, six 7-inch aluminum gate valve assemblies, and four 7-inch aluminum tee assemblies. Connections between components are made with 7-inch hoseline assemblies, both suction and discharge. Note that each BFTA comes with a 10-foot section of 7-inch suction hose and a 7-inch aluminum gate valve which are incorporated into the hoseline layout. Each tank is also supplied with a 4- to 6-inch adapter and a 6-inch cam lock to double-groove adapter to allow the tank to be used separately. Two 6-inch Ts are provided to be used as required.

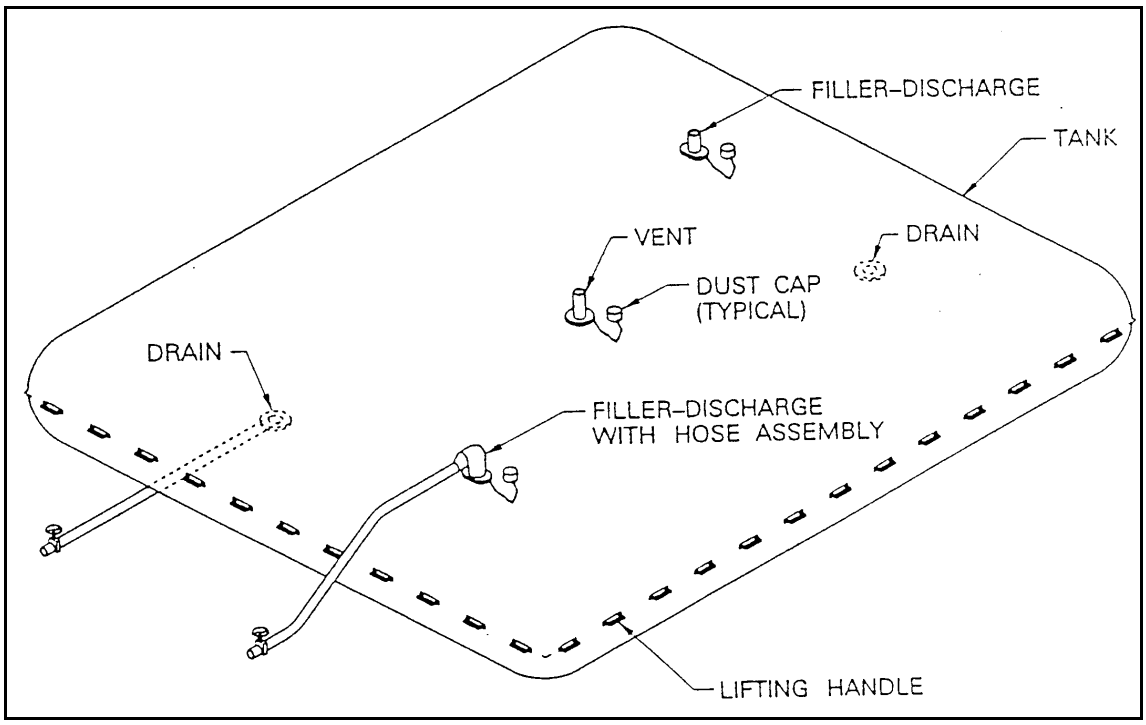

Figure 6-3. The 5,000 barrel fabric collapsible tank

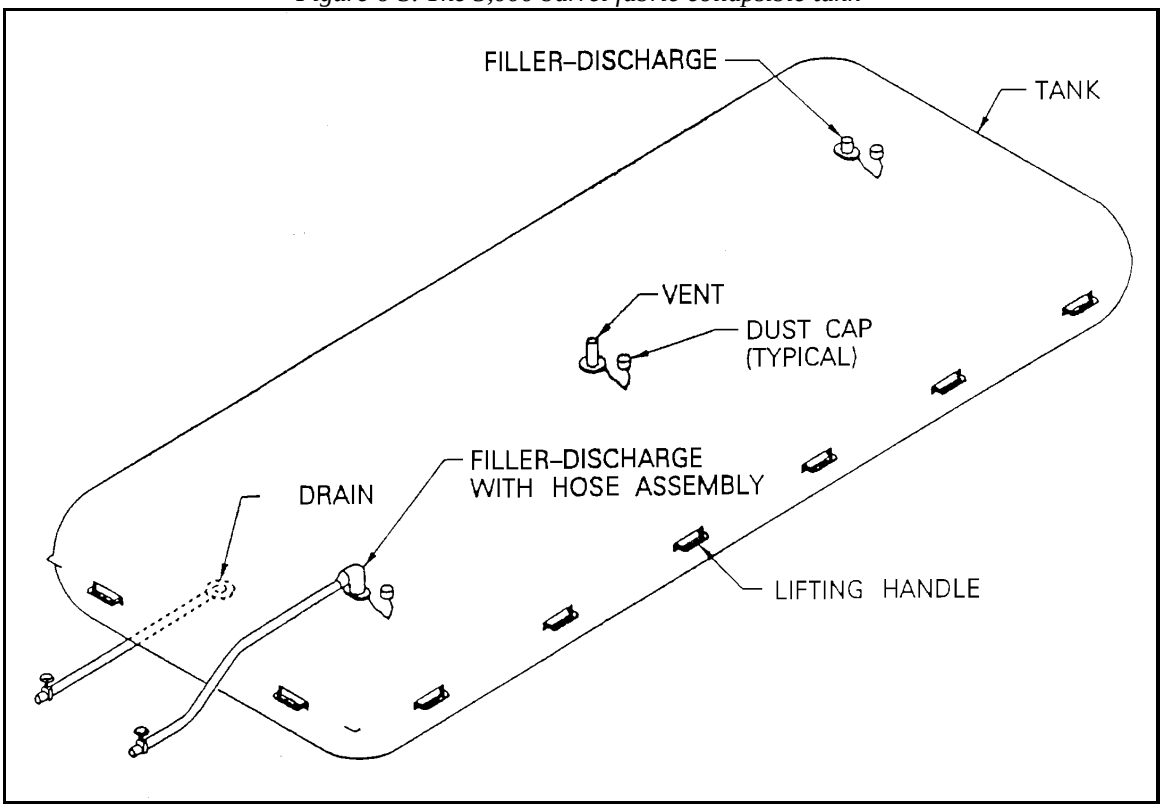

Figure 6-4. The 50,000 gallon fabric collapsible tank

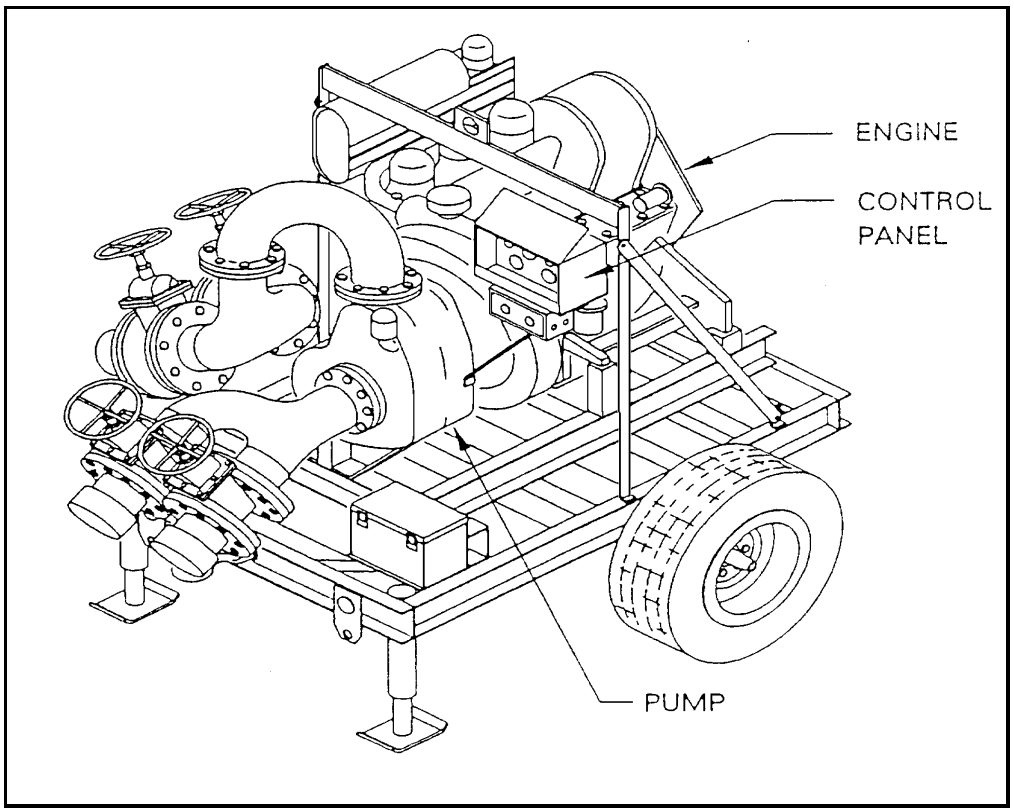

Figure 6-5. The 350 GPM pump

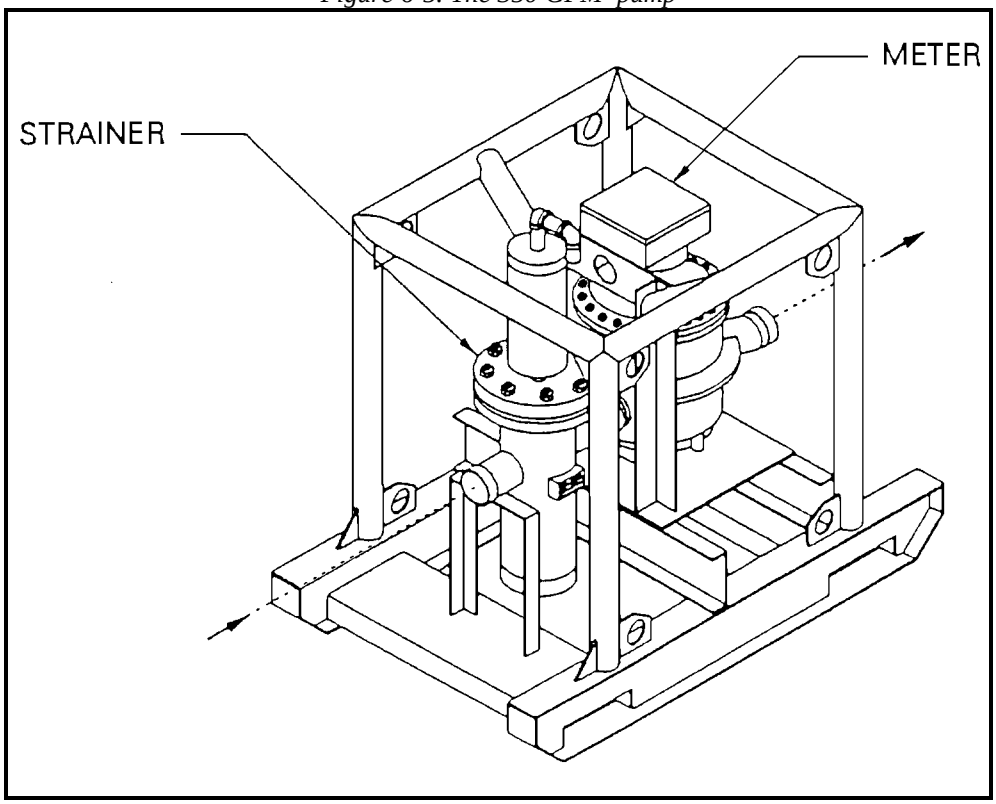

Figure 6-6. The meter/strainer assembly

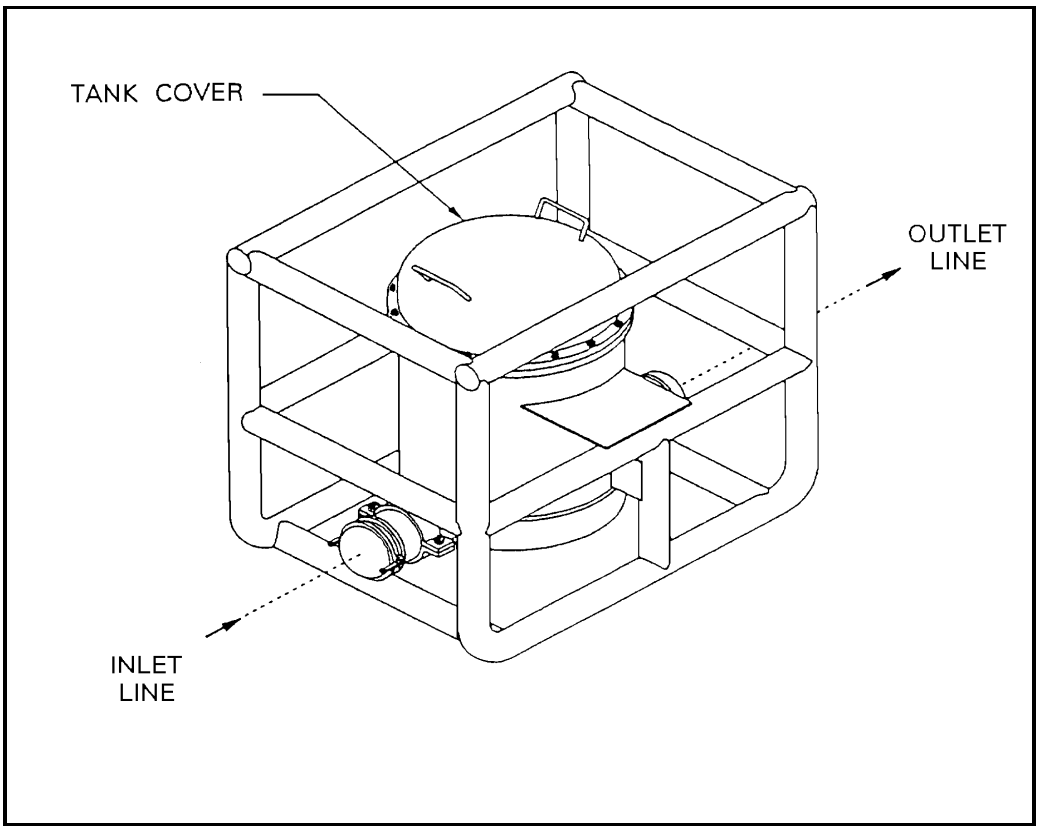

Figure 6-7. Filters separator, liquid fuel

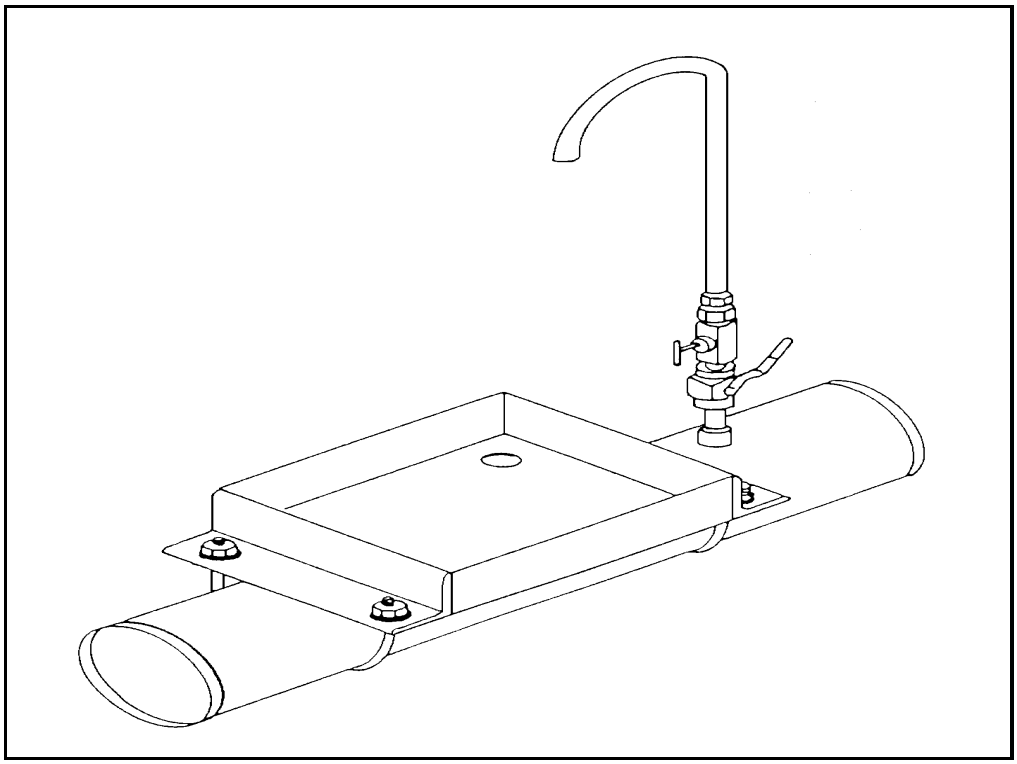

Figure 6-8. Fuel sampling assembly

Section III. Tank Farm Installation

LAYOUTS

The layout requirements for a TPT must be flexible to fit the particular site and service. These arrangements may be modified for practicality at a particular site. The objective in any equipment arrangement is to provide for efficient and safety in operations. As a general rule, the TPT should be arranged for maximum spacing between tank farm units and fuel units to the extent the particular operating site requirements and hoseline availability permit. This will provide for the highest level of safety for the equipment and the operating personnel without adversely affecting operating efficiency. Specific area service requirements may also affect layout and spacing. For detailed information on TPT layout, refer to FM 5-482.

Typical TPT Layouts

A typical TPT layout is shown in Figure 6-9, page 6-13. This layout is an example of a TPT which has been arranged to make full use of the transfer hoseline provided for wide spacing between fuel modules. The layout assumes that adequately sized property is available and the equipment is wide spaced for security reasons. In many locations, due to terrain or operational situations, the layout may have to differ substantially from that shown. In a relatively secure area or when property available is limited, it will be appropriate to arrange the system with much closer spacing between fuel units and equipment. A typical close-spaced TPT layout is shown in Figure 6-10, page 6-14 . It is not imperative to lay out tankage in a straight line. Security demands or terrain may dictate otherwise. Road access should always be considered when planning a TPT site. Ideally, there should be a limited number of entry points into the TPT area, with each entry point having a control or checkpoint to monitor and route traffic in and out of the area. A road that can support two-way tank vehicle traffic should run along the perimeter of the TPT site. This road would give access to each fuel unit's fuel-dispensing assembly. In the fuel-dispensing areas, the roadway should be widened to at least 40 feet. Through traffic should be routed away from the fuel-dispensing area. Similar fuel handling areas are needed for the contaminated fuel module and the tanker truck receipt manifolds. Secondary roads should be made for MHE, pumps, fire-suppression equipment, and maintenance equipment to be moved. Under-road culverts through which hoselines pass allow vehicles to cross over the hoselines without damaging them. These culverts are installed as necessary. The hoseline suspension kit may also be used to provide for crossing under the hoseline. Access must be provided to the pumps and near each tank berm. An important point shown on the general TPT layout is the location of the fire-suppression equipment. A wheel-mounted fire extinguisher should be located near each tank berm, at each fuel-dispensing assembly, at each tank vehicle receipt assembly, and at the contaminated fuel module. Extra units should be stationed at a central point ready for use anywhere in the TPT. Covered shelters or containers for housing the Kevlar fire-fighting clothing and extra fire fighting supplies should be provided at central, easily accessible locations around the TPT. The 20-pound hand-held fire extinguishers should be distributed and located at each pump, each floodlight set, each fuel-dispensing area, and other operating areas at the discretion of the operating supervision. Personnel must know where all fire-fighting equipment is located at all times to prevent confusion in an emergency. Readily visible signs flagging the locations of fire extinguishers would be helpful. The floodlight sets should be placed to give light to the fuel-dispensing areas, fuel receipt areas, and heavy operating areas around the pumps and the switching manifold.

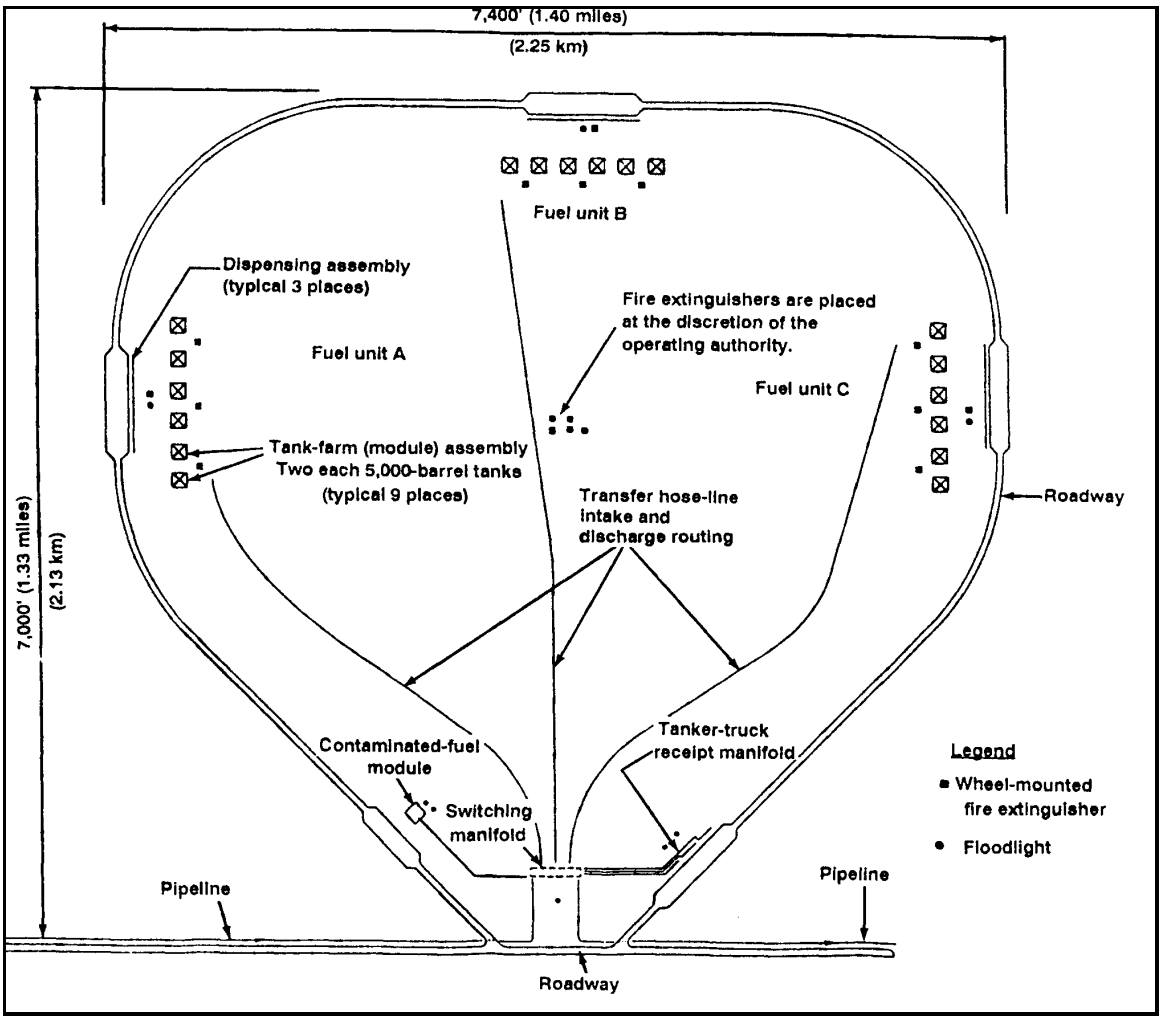

Figure 6-9. Typical wide-spaced TPT layout

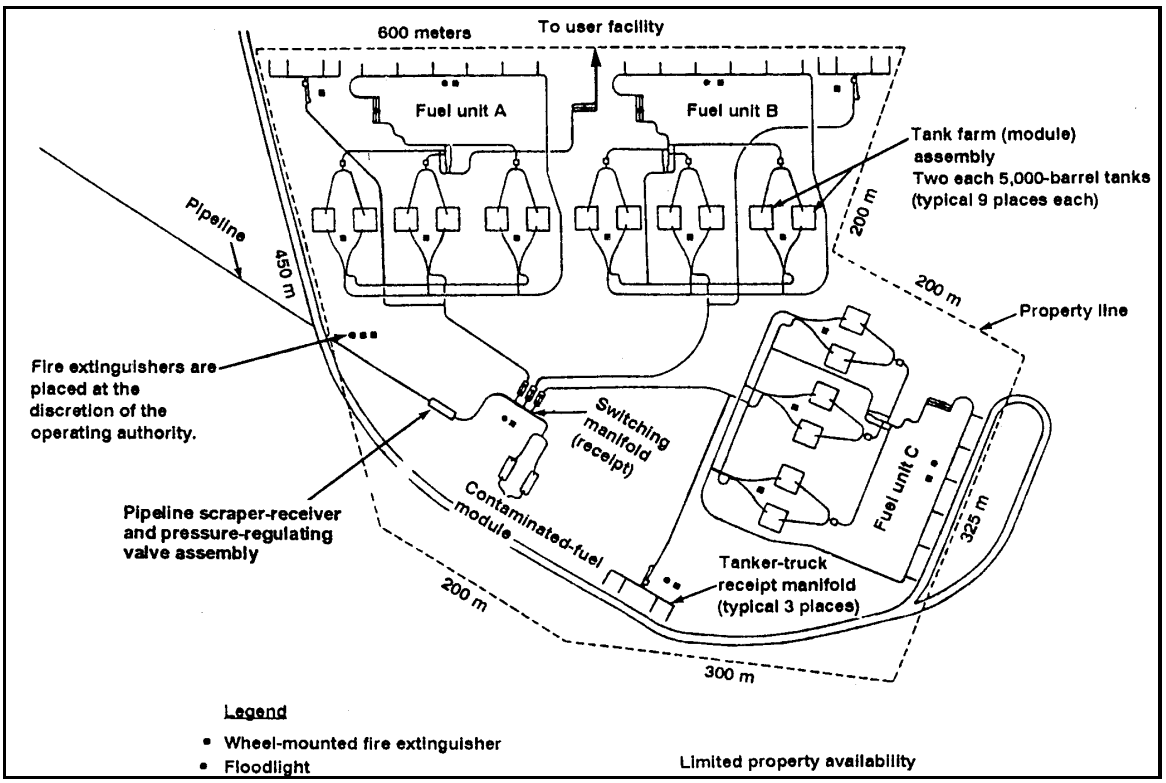

Figure 6-10. Typical closed spaced TPT layout

SITE SELECTION

Using both aerial and ground reconnaissance, the Army will probably preselect a specific site or at least a desired area in which to set up the TPT. (Refer to FM 5-482 for detailed information on site selection). There is not a completely ideal site. When picking a site, a decision must be made. When evaluating the site, these factors must be considered in site selection.

- Distribution Plan. The need for the terminal in a general area can be decided only by the U.S. Army's distribution plan.

- Relation to the Area System. The ability to supply the terminal with fuel must be considered. This will consider the primary source of supply and the hydraulics of the pipeline to the terminal. In most cases, the distribution plan will be the main factor. It will cause the associated pipeline system design to be such that it can deliver to the TPT site selected.

- TPT Site Size. The site selected must be able to hold the equipment and roadways needed. The previous paragraphs discuss these site requirements. Compromise and rearrangement of equipment will often be necessary.

- Suitability of Terrain. The selected site should be reasonably level and well drained especially where the individual storage, loading, and unloading of equipment are planned. The least amount of earth moving work needed is better. The less, the better. Low and swampy areas should be avoided. The site should be as free as possible from heavy obstructions such as large rocks and trees.

- Road Access. If possible, the site should be located relatively near existing road systems capable of carrying the traffic involved. There must be access to that road system or a new road may need to be constructed to connect the roads.

- Water Availability. Water must be available at the site or making it available at the site. The operation must have water available for safety reasons even if it must be hauled to the site. Water must be available for the charging of the dry chemical/AFFF wheel-mounted fire extinguisher. It is also needed for general fire protection and personnel safety.

- Layout. After the site has been selected, a preliminary layout should be made. This shows all the major equipment and system locations, including tanks, pumps, floodlight sets, fuel-dispensing areas, tank vehicle receipt areas, and the access roads. The characteristics of the site available should be evaluated. Then the preliminary layout should be reviewed and corrected if needed for a final layout on which equipment locations are firm. Final roadwork and tank pad and berm construction must be based on this final layout.

SITE PREPARATION AND EARTHWORK

Final site selection and subsequently site preparation and earthwork must be based on the layout discussed in the previous paragraph. The site will probably not be ideal; therefore, there must be some give and take between the layout and site preparation results. Site preparation work should be based on a grading plan that reduces cut and fill operations even if the plan is roughly prepared in the field. The plan should be based on actual on-site elevations and survey, observation of obstructions, and knowledge of the types of soils that appear to be present. The first step to prepare the site is to cut an access road to the site unless one already exists. Stake out the area that must be cleared. Mark where the major components will be located. Cut, grub, doze, or if necessary, blast major obstructions; for example, trees, boulders, or buildings. Clear and grade the areas where a fuel unit will be located, transfer systems installed, roadways built, and loading and unloading facilities installed. There must be good drainage from the site. Plan cuts and fills so that the volume of cut soils roughly equals the required fill for low spots, tank berms, and roadways. If the area is fairly flat and requires only minimal grading, the materials for roadways and tank berms can come from a borrow pit near the site which can, if desired, be converted to a reserve water storage basin. Keep in mind that the major equipment, most particularly the BFTAs, should be set on virgin or cut soils, if possible, rather than on fill. If tankage must be located on a filled area, the fill must be compacted as it is placed. Compaction after a deep fill has little effect. When extensive fill is required, the slopes must be such as to prevent slides and reduce erosion. As a general rule, there should be no slopes greater than 2:1 (approximately 25°) in sandy or loamy soils.

Road

Road must be fully compacted and have good drainage. If possible, they must have at least a surface of gravel or crushed rock. Each side of the road should have an adequate swale or ditch for good drainage. Drainage culverts should be placed as required. The road, swale, ditch, and drain culvert requirements will depend on the site and anticipated rainfall. Roads must be constructed to permit ready access to all areas for installation, operation, fuel loading and unloading, and fire fighting.

Tank Pad and Berm Construction

Proper tank pad and berm construction is most important to provide for tank operation and protection from spill or a fire resulting from the spill. Tank pads are preferably constructed of a loamy or clay soil containing some sand so that a smooth area can be graded and hold its shape. The longest slope should be approximately 1° (degree) from horizontal. The low point should be where the tank drain will end up when the tank is unrolled. A small ditch and a basin for the tank drain line and drain valve can be excavated by hand at the time the tank is unrolled. The low point permits maximum pump out of the tank and drainage through the drain line. The base of the tank pad area must be virgin, cut, or well compacted soil. To avoid damage to the tank bottom, sticks, stones, or sharp objects must be removed before the tank is installed. Berms may be constructed before, after, or simultaneously with tank pad construction, depending on job conditions. The tank must be cleared on any rocks or clumps, that roll on to the tank pads during berm construction. Tank pad rough grading should be completed before berm construction and should be finished after berm construction. The preferred materials are soils containing a fairly high

clay content to hold shape and sealing. The berm should be compacted as it is constructed. An alternate to graded berms are sandbag berms as described earlier. If a berm drain is installed, as recommended, it should be laid in a hand-cut trough after the first layer of berm is placed and before the second layer is placed. Care must be taken to avoid damage by the equipment constructing the berm. This can best be handled by not installing the valve until after the berm is completed and giving the berm drain pipe plenty of cover. When the drain valve is installed, it should be left closed, or the integrity of the berm has been compromised. Berm liners should be installed after the pad and berm are completed. A light layer of soil (without rocks) may be spread over the liner to protect and hold it in place.

Pads for Other Equipment

To the extent possible, all operating equipment should be set on virgin or cut soils rather than fill. If a filled area cannot be avoided, it must be well compacted. This is particularly important for the pumps and floodlight sets. If available, it is recommended that the areas on which equipment is placed be covered with a 6 to 7-inch layer of coarse gravel or crushed rock. The gravel or crushed rock should extend out and around the equipment for several feet. This will provide a high and dry area from which to operate and maintain the equipment. If coarse gravel or crushed rock is available, place it around often-operated valve stations.

EQUIPMENT INSTALLATION

This section lists the equipment in the recommended installation sequence. Major equipment is installed first, followed by major fittings and valve assemblies, and then by the interconnecting hoselines. The transfer hoselines can be laid as soon as the location of the switching manifold is Setup. When equipment, valves, fittings and hoses are being installed, internal cleanliness is very important. Sand, rocks, rags, tools, or clothing left inside will block the fuel flow or damage equipment. Leave protective caps and plugs in place until actually ready to make a connection. Before closing a joint, inspect the parts being assembled and remove any foreign material.

FLOODLIGHT SETS

Install the six floodlight sets that come with the TPT as soon as possible. Sufficient light must be available for night TPT installation. Install the floodlight set according to the manufacturer's manual. The location of the sets will depend on characteristics of the field site.

BFTA

Make sure that the tank pads are free of sharp objects and smooth before rolling out the tanks. The drain on the tank should be located over the low spot in the pad and the top fitting intended for pump suction is the one closest to this drain. Cut a small trench for the drain hose before unrolling that end of the tank under which the drain hose will pass. After cutting the trench, install the drain hose and valve assembly. Service, install on assigned pads, and assemble all components of the BFTAs as described in the TM overpacked with the tanks. Six BFTAs are supplied per fuel unit and 18 per TPT.

The 50,000-Gallon Fabric Collapsible Tanks

Install the 50,000-gallon tanks the same as for the BFTAs.. Service, install on assigned pads, and assemble all components IAW TM 5-5430-210-12. Up to six tanks are in the optional tank configuration and two per contaminated fuel unit.

The 600-GPM Hoseline Pumps

Three 600-GPM pumps come with each fuel unit and nine per TPT. One 600-GPM pump come with the tank vehicle receipt manifold and three per TPT. The TPT comes with three spare 600-GPM pumps for use as needed. Ground the pumps when they are installed. Install the 600-GPM pumps as far from the collapsible tanks as possible without deforming the tank top or causing long unsupported lengths of suction hose. The suction hose should lay on the ground without strain on the tank or pump. Pump engines and exhaust fumes are hot. For safety reasons, keep them as far as practical and distance from the tank will enhance safety. Install, service, and prepare the 600-GPM hoseline pumps for operation IAW the technical manual overpacked with each pump.

The 350-GPM Transfer Pump

Install the one 350-GPM transfer pump with the contaminated fuel unit. The same preparation procedures are used as with the 600-GPM pump. Install, service, and prepare the 350-GPM transfer pump IAW TM 5-4320-226-14.

Meter Skid Assemblies

Install the meter skid assemblies. Three are supplied per fuel unit supply hoseline and one per common header to associated pipeline or hoseline system. Service and prepare the assemblies IAW the manufacturer's manuals overpacked with the equipment. Ground the meter skid assemblies when they are installed.

Filter Separators

Install, service, and prepare the filter/separators IAW TM 5-4330-211-12. Ground the filter/separators when they are installed. Three filter/separators are installed with each fuel-dispensing assembly and nine per TPT.

Tank Farm Unit Assembly Hoselines, Valves, and Fittings

The following installation and assembly procedures are based on the shared berm layout shown in Figure 6-11, page 6-18.

- Position crates containing Ts, pumping assembly, and gate valves near their respective installation sites around the fabric collapsible tanks.
- Remove the 6-inch aluminum Ts, gate valves, adapters, coupling clamps, and coupling gaskets from the crates. Inspect all items for damage, cleanliness, and quantities required.
- Align mating surfaces of adapters, gate valves, and Ts.

NOTE: When installing coupling clamps and gaskets, liberally apply grease to the gasket and the inside surface of coupling clamp to prevent pinching during installation. Then, pull the coupling gasket over one grooved end of each mating joint. Ensure the gasket is properly positioned over the full circumference of the sealing surfaces. Position the coupling clamp over the gasket. While maintaining alignment of mating parts, lock the coupling clamp securely. Make sure all hoselines, fittings and valves are clean internally. Foreign materials may stop operations and damage equipment.

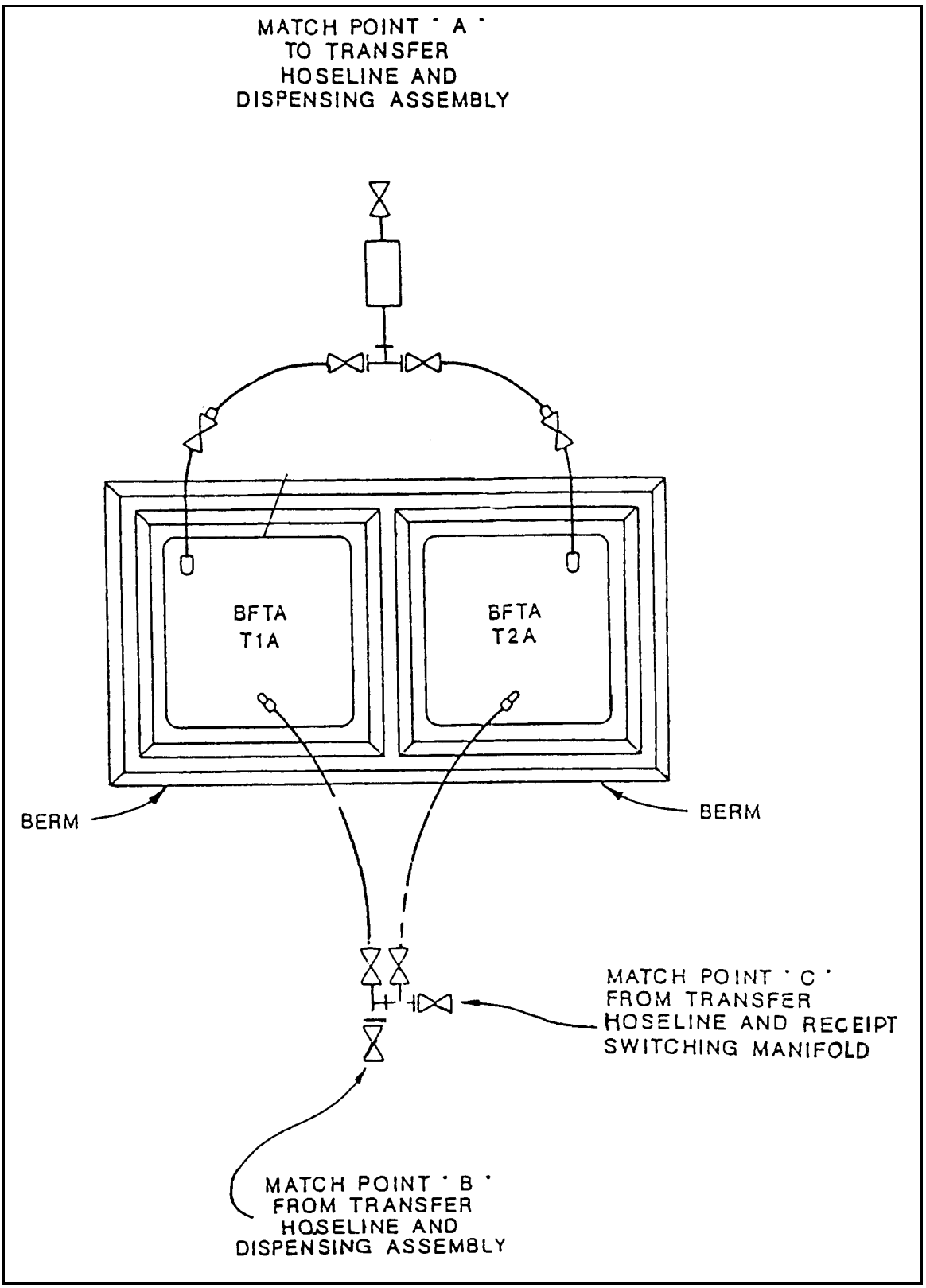

Figure 6-11. Tank farm (Module) assembly layout, typical layout with separate berm constuction, hose, valve, and fitting installation

Check the position of the 600-GPM hoseline pump

- Place crates containing hose and fittings near their respective installation position.
- Uncrate and position the 6-inch discharge hose assemblies.
- Remove the dust caps and connect the 5-inch suction hose and gate valve assembly to the tank elbows.
- Connect the coupling adapters to the gate valves.
- Connect the 6-inch suction hoses between the coupling adapters and the gate valve assembly.
- Connect the 6-inch suction hose to the T assembly and inlet side of the pump assembly.
- Connect the 6-inch discharge hose between the outlet side of the pump assemblies and the gate valve.
- Connect the 6-inch gate valve to the transfer hoseline.
- Connect the coupling adapters to the tank elbows.
- Connect the 6-inch discharge hoses between the coupling adapters and gate the valve assemblies.
- Inspect all connections to verify correct installation of coupling clamps, coupling gaskets, and security of cam-lock devices.

CONTAMINATED FUEL UNIT HOSELINES, VALVES, AND FITTINGS

The following assembly and installation procedures are based on the contaminated fuel module layout. Make sure all hoselines, fittings, and valves are clean internally. Foreign materials may stop operations and damage equipment.

- Connect elbows to the outlet ports of the 50,000-gallon tanks. Connect 6- by 7-inch reducers to the elbows.
- Connect the coupling adapters to the 6-inch by 7-inch reducers.
- Install the 6-inch discharge hoses between the coupling adapters and the gate valve assembly.
- Connect the gate valves to the 6-inch T.
- Connect the 6-inch discharge hose between the 6-inch tee and the beginning of the transfer hoseline.
- Connect elbows to the inlet ports of the 50,000-gallon tanks.
- Connect 7-inch suction hoses to the tank elbows and 7-inch gate valves.
- Connect the 7-inch suction hoses to the suction side of the 350-GPM transfer pump and the 7-inch gate valve assemblies.
- Connect the 7-inch discharge hoses to the discharge side of the transfer pump.
- Connect the 7- by 3-inch reducer and the 3-inch ball valve assembly to the 7-inch discharge hose.
- Inspect all connections to verify correct installation of the flanges, coupling gaskets, clamps, and security of cam-lock couplings.

TRANSFER HOSELINE ASSEMBLY, VALVES, AND FITTINGS

One transfer hoseline assembly is supplied with each fuel unit; three assemblies per TPT. The transfer hoseline set assemblies are crated in a partially assembled condition to ease packaging and shipping. Some assembly is required to place the Ts and gate valve assemblies in operating condition before installation. The following installation procedures are based on the transfer hoseline assembly layout. Make sure all hoselines, fittings, and valves are clean internally. Foreign materials may stop operations and damage equipment.

- Position crates containing 6-inch Ts and gate valve assemblies near their respective installation.
- Remove the 6-inch aluminum Ts, 6-inch aluminum gate valve assemblies, coupling clamps, and coupling gaskets from the crates.
- Inspect all items for damage, cleanliness, and quantities required.
- Tighten flange adapters to the gate valves, being careful not to damage the gasket.
- Connect the gate valves to the Ts.
- Connect the needed quantity of transfer hoseline between the outlet port of the meter strainers and Ts. (Depending on which TPT is available, the transfer hoseline will be supplied either in 250-foot lengths stored in flaking boxes or 600-foot lengths stored on hose reels.)
- Inspect all connections to verify correct installation of flanges, coupling gaskets, clamps, and security of cam-lock devices.

Fuel-Dispensing Assemblies

One fuel-dispensing assembly is supplied with each fuel unit; three per TPT. Make sure all hoselines, fittings, and valves are clean internally. Foreign materials may stop operations and damage equipment.

Installation of Coupling Clamp and Gasket

- Liberally apply grease to the gasket and the inside surface of the coupling clamp to prevent pinching during installation.
- Pull the coupling gasket over one grooved end of each mating joint.
- Ensure the gasket is properly positioned over the full circumference of the sealing surfaces.
- Position the coupling clamp over the gasket. While maintaining alignment of mating parts, lock the coupling clamp securely.
- Check the position of the 350-GPM filter separators.
- Connect the 6x6x4 reducing tee adapters, 7-inch dispensing hose, 7-inch gate valves, and adapters to the inlet side of the filter separator.
- Connect the adapters, water detection kit adapters, 7-inch gate valves, 7-inch dispensing hose, adapter, and 7-inch 6x6x4 reducing tee to the outlet of the filter separators.
- Connect the 6-inch discharge hoses and the 6x6x4 reducing tee.
- Connect the 6-inch ball valve assembly to the 6-inch discharge hose.
- For the first six 6x6x4 reducing tees, install a 7-inch dispensing hose between the 7-inch butterfly valves and the 7-inch adapter connection on the reducing tees.
- For the two remaining tees, connect the adapter to a 7-inch to 2-inch reducer to the 6x6x4 inch tees.
- Connect the 2-inch to 1 1/2-inch reducer to the 7-inch to 2- inch reducer.
- Connect the 1 1/2-inch ball valve to the 2-inch by 1 1/2- inch reducer.

- Connect the 1 1/2-inch pressure control valve to the 1 1/2- inch ball valve.
- Install the 1 1/2-inch dispensing hose on the outlet port of the pressure control valve.
- Connect the 1 1/2-inch ball valves to the ends of the 1 1/2-inch dispensing hose.
- Connect the 6-inch ball valve to the last reducing tee.
- Connect the 6-inch pressure control valve to the 6-inch ball valve.
- Inspect all connections to verify correct installation of flanges, coupling gaskets, clamps, and security of cam-lock devices.

NOTE

Liberally apply grease to the gasket and the inside surface of the coupling clamp to prevent pinching during installation. Then pull the coupling gasket over one grooved end of each mating joint. Ensure the gasket is properly positioned over the full circumference of the sealing surfaces. Position the coupling clamp over the gasket. While maintaining alignment of mating parts, lock the coupling clamp securely.

TANK VEHICLE RECEIPT MANIFOLD HOSELINES, VALVES, AND FITTINGS

The tee assembly used in the tank vehicle receipt manifold is crated in a partially assembled condition to facilitate packaging and shipping. Some assembly is required to place the unit in operating condition prior to installation. Make sure all hoselines, fittings, and valves are clean internally. Foreign materials may disrupt operations and damage equipment. The following installation procedures are based on the tank vehicle receipt manifold shown in FM 5-482.

- Position crates containing tank vehicle receipt manifold components in their respective installation positions.
- Remove the components from the crates as required.
- Check the position of the 600-GPM hoseline pump.
- Connect the 6-inch tee to the 6-inch gate valve and discharge hose assembly. Connect these to the discharge side of the pump.
- Connect the 6-inch suction hose to the suction side of the pump.
- Connect the 6-inch gate valve to one leg of the tee, then connect the 6-inch discharge hose to the gate valves.
- Position and connect the two remaining tees. Install the 6- inch gate valves.
- Connect the suction hoses and 6x6x4 tees.
- Connect the coupling adapters to the tee fittings.
- Connect the 7-inch suction hoses to the coupling adapters.
- Connect the 7-inch butterfly valves to the suction hoses.
- Install the 6-inch caps on the tee fittings.
- Connect the 7-inch by 3-inch reducer to the butterfly valves.

SWITCHING MANIFOLD

The following assembly and installation procedures are based on the switching manifold shown in FM 5-482. Make sure all hoselines, fittings, and valves are clean internally. Foreign materials may disrupt operations and damage equipment.

- Position the crates containing the 6-inch aluminum tees, 6- inch gate valves, 6-inch sampling assembly, 6-inch ball valves, hose assemblies, meter skid assemblies, and pressure regulating valve assembly near their respective installation sites as indicated.
- Remove tees, valves, hoseline, pressure regulating valve assembly, sampling assembly, meter skid assemblies, adapters, coupling clamps, and coupling gaskets from the crates.
- Inspect all items for damage, cleanliness, and quantities required.
- Connect the 6-inch tees together to form the configuration shown in FM 5-482.
- Connect the gate valves and ball valve assemblies to the tees.
- Connect the discharge hose between the gate valves and meter strainer assemblies as well as between the tee and meter strainer on the return manifold.
- Connect the fuel sampling assembly to the tee as shown in FM 5-482. In some cases hose may be in between the sampling assembly and the switching manifold.
- Install the pressure regulating valve assembly in the pipeline to the switching manifold, upstream of the fuel sampling assembly or as directed by the operating authority. Six-inch IDS single groove pipe is supplied by the associated pipeline. If the system does not involve an associated pipeline, the feed line (hose or pipe) can be tied directly into the pressure regulator and all downstream conduit can be hoseline.

CAUTION

Upstream (back pressure) and downstream (reduced pressure) pressures are preset as intended to 50 PSI upstream minimum and 125 PSI downstream maximum. DO NOT bypass upstream or downstream pilots without supervisory instructions. Bypassing the downstream pilot can result in pressure or reduced pressure control settings without operating authority approval.

- On the return manifold, connect the discharge hose between the outlet side of the meter strainer and the single to double- groove adapter.
- Inspect all connections to verify correct installation of flanges, coupling gaskets, clamps, and security of cam-lock devices.

OPTIONAL TANK CONFIGURATION HOSELINES, VALVES, AND FITTINGS

The following assembly and installation procedures are based on the optional tank configuration. Make sure all hoselines, fittings, and valves are clean internally. Foreign materials may disrupt operations and damage equipment.

- Connect elbows to the 50,000-gallon tanks.
- Connect the 7-inch suction hose assemblies to the elbows.
- Connect the 7-inch suction hose assemblies between the 7- inch suction hose assembles and the wye assemblies. Ensure the correct hose lengths are installed in the positions shown. Make sure the correct bend radii are maintained.
- Connect the 7-inch suction hoses between the 7-inch tee assembles and the wye assemblies.
- Connect the reducer and coupling adapter to the tee assembly.

- Connect the tee to the reducer.
- Connect the elbows to the tanks.
- Connect the 7-inch discharge hose assembles and to 7-inch gate valve assemblies.
- Install the wye assemblies to the 7-inch gate valves.
- Install the 7-inch discharge hose between the wye assemblies and the 7-inch tee assemblies.
- Connect the reducer to the 7-inch tee assembly. Connect the coupling adapter to the reducer.
- Connect the tee to the adapter.
- Inspect all connections for correct installation of flanges, coupling gaskets, clamps, and security of all cam-lock devices.

FIRE SUPPRESSION EQUIPMENT

Check out, service, and install the fire suppression equipment in accordance with the overpacked instructional manuals and specific instruction of operating management. The wheel-mounted dry chemical/AFFF units should be located such that they can be readily put into service at the fuel storage units, fuel-dispensing sets, the switching manifold, the contaminated fuel module, and the tank vehicle offloading area. U.S. Marine Technical Manual 07661B-14/1 contains instructions on the dry chemical/AFFF unit. The 20-pound fire extinguishers should be placed according to the direct operating authority. It is recommended that one be placed near all pumps, floodlights, and loading spots. Placement of the extra extinguishers not specifically located should be just outside the immediate operating area in a highly visible location.

CAUTION

Thoroughly check out all fire suppression equipment at the time of locating in the unit. Extinguishing equipment must be charged and in working order. Clothing must be clean and in good condition. Clearly mark storage areas for fire suppression equipment and educate all personnel on its location and use prior to bringing flammable fuels to any part of the system.

SAFETY AND NO SMOKING SIGNS

Prepare and install appropriate safety and no smoking signs at designated locations for the specific site. No smoking is allowed within 50 feet of any system or equipment containing flammable fuels. Set up "No Smoking" signs just outside of this boundary area. Set up "No Smoking" signs around fuel-dispensing and fuel receipt areas. To minimize the threat of smokers, create a well- marked "Smoking Permitted" area well away from the facilities and make that the only area in which smoking is permitted. This area should not be lower than or down wind of the fuel handling area. Set up "Shut Engine Off" signs at fuel-dispensing and receiving areas. Set up "Disconnect Hose Before Moving Vehicle" signs at dispensing and receiving areas. Place the following safety signs at appropriate locations:

- "Danger - Hot Surfaces" - at pump engines.
- "Danger - Moving Parts" - at pump and engines.
- "Danger - Wear Goggle and Gloves" - at sampling position.
- "Watch Your Step" - in congested areas.

PRESSURE TEST SYSTEM

The TPT system, particularly the hose systems, should be pressure tested before it is placed in operation. The purpose of the test is to prove the integrity of the system, by locating leaks, blockages, and installation faults. The test is not to prove the strength of the materials; therefore, test pressures are limited to the maximum design operating pressures. A complete test is recommended; however, it is understood that some deviation may be required due to specific site conditions and immediate operating needs. The extent of pressure testing and the test media used is up the operating authority.

Test Medium.

Tests can be conducted with air, water, or fuel. The medium used is dependent on the conditions at the specific site and installation/operations management decision. From a safety standpoint, a water test is the safest medium. However, it has certain disadvantages, such as the difficulty of removing all water from the system. Air tests should not be conducted at pressures in excess of 50 PSI and, therefore, cannot be used to locate leaks that occur at higher pressures. A fuel test can be handled safely if care is taken and the method will save time and is considered adequate. If a fuel pressure test is conducted, it can be handled in conjunction with the purge and commissioning program. After the test medium has been decided and the line to be tested is filled, bring the test pressures up and hold them long enough to thoroughly inspect the system for leaks and faults. The test pressure is then taken off the system and the leaks and faults corrected. The system must be retested after these corrections are made. A longer period of holding the system at test pressures may be opted for at the discretion of the operation/installation authority.

Maximum Test Pressures.

Testing is for locating leaks, loose connections, blockage in the system, and flaws in construction. Testing will prove the integrity of the facility prior to regular operation. The test pressures listed below are less than maximum pressures. The operating authority may designate lower pressures at their option. When testing fabric collapsible tanks, no pressure is allowed other than static liquid head plus .10 PSI. Make sure the tank vent is open and clear. The tanks may be filled to approximately 85 percent of their design capacity with fuel. All inlet and outlet valves must be closed and blanked off. Inspect for leaks. If any leaks develop, the tank must be emptied and repaired, tank refilled, and inspected for leaks. If sections of pipeline, connected with a suction hose, are being tested to higher pressures, the suction hose must be blanked off and tested separately. Pressure tests may be performed using water, fuel or air. The maximum test pressures for 7-inch pumps and smaller discharge hoses, valves and fittings are 150 PSI when testing with water or fuel. The maximum test pressure for suction hose are 150 PSI when testing with water or fuel. The maximum test pressure when testing with air is 50 PSI for 7-inch pumps, smaller discharge hoses, valves and fittings, and suction hoses.

Maximum test pressures for 6-inch pump discharge and transfer hose, valves, and fittings are:

NOTE

Certain fittings are rated at 75 PSI maximum. These items are not to be exposed to test pressure above 75 PSI. They can be isolated or removed during the test.

Test Pressure Source.

Test pressure can be supplied from any source capable of holding the test pressures. The 600-GPM hoseline pump is suitable for testing with water or fuel. An air compressor must be available to proceed with an air pressure test. All test media, water or fuel, if incompatible with the particular fuel service for which the system is intended, must be drained from the system before it is placed in service.

CAUTION

Under no conditions are air pressure tests to be used on fabric collapsible tanks. Remove all connecting hoses to tanks to prevent this. Pumping air into fabric tanks can exceed the tanks venting capacity, inflate, and possibly rupture the tanks.

Preparation for Testing.

Before the test is begun, actions should be taken to ensure that the test runs smoothly. Be certain that there are sufficient gaskets, repair equipment, etc. available. Locate fire suppression equipment near the testing area and be sure that it is in operating condition (when testing with fuel). Make sure to have a tank vehicle and drums available, in case a section has to be drained and have shovels amd materials available to dig and line a pit in case there is a break and spill (when testing with fuel). Have caps and plugs available to blank off the section under test. Valves in the system may be used to isolate hose sections as necessary. After all the TPT equipment, hose, valves, and fittings are physically connected, there should be a meeting of all responsible personnel connected with the testing program. Each phase of the test plan including a communication plan shall be discussed and reviewed. Prior to filling a section for test, a final check should be made to verify:

- All valves are in proper position for filling.
- All hoses, valves, and fittings connections are tight and valve packing glands are tight.
- Pumps are in good working condition.

Fuel Test Procedure.

Adjust valves so that fuel can be pumped through the section under test, exhausting air. Slowly pump fuel into the system, not to exceed a flowrate of 200 GPM. When all air is evacuated, close the discharge valves, fill the section with fuel, and stop the pump. Check all connections for leaks. If no leaks are found, start the pump and raise the pressure to 25 PSI, stop the pump, and check the gages. If no leaks are found and gages are okay, start the pump and raise the pressure to the selected test pressure. Stop the pump, check for leaks, and hold the test pressure for a period long enough to inspect the entire system under test. If leaks are found, relieve the pressure, drain the leaking section, and make repairs, adjustments, or replacements as necessary. At that point, pressure up the section again to test the repairs made.

CULVERTS

Install culverts at road crossings where hoselines cross under an area where vehicle traffic is planned. Erect signs advising drivers that there is a crossing at that point. Place "Danger, Hoseline Crossing" signs where they are needed. Hoselines can be easily damaged by vehicles crossing them. Be sure well covered culverts are installed where traffic is expected. Permit no vehicles to cross unprotected hose.

HOSELINE SUSPENSION SETS

Install suspension sets at road crossings, small streams, and other areas where a nestable culvert may not be used.

RANGE POLES

Each BFTA is supplied with two range poles, 36 per TPT. Install the range poles and cords at all BFTA sites.

PAINT SYSTEM

Paint all metal parts that have not been previously painted or anodized to acceptable standards or that have deteriorated in shipment and storage. Prepare the surfaces and apply primer in accordance with MIL T-704, Type A and finish coat per MIL-E-52798, Type I, sand color.

EQUIPMENT AND LINE IDENTIFICATION MARKING

Mark all major equipment, tanks, pumps, meter-strainers, filter- separators, operating valves, and pump pressure gages with the equipment identification numbers. for efficiency and safety in operations. Equipment that has large enough surfaces should be stencil painted using a color that contrasts well with the background. Small valves and other small equipment can be marked with metal strips bearing the equipment number and wired in place. This should be done after installation to make sure numbering is correct. Consider marking hoselines and pipelines with color-coded bands and direction of flow arrows as described in MIL STD 161. Care must be taken to correct the marking if the service of a marked section of hose is changed.

AREA CLEANUP

The installation personnel must clean up the area prior to starting operations. They must remove all construction dregs, obstructions, and boxes. Unused materials, hose, fittings, and the like should be stored in a specific area for future use. All dust caps and plugs should be boxed and marked for use in the event the system is disassembled for shipment. The ISO container supplied with the TPT for ISIL parts may be used for this purpose.

FINAL INSPECTION

It is important to make a final inspection using a checklist arranged essentially in the order of this installation procedure. This should be done by supervisory and management personnel from both the installation and operating groups. The following inspection points should be emphasized:

- Integrity and height of tank berms - closed berm drain valve.
- Floodlight location, operability, and grounding.
- Fabric collapsible tank layout and connections.
- Pump location, operability, servicing, and grounding.
- Meter-strainer flow direction and grounding.
- Filter separator flow direction, test adapter installation, and grounding.
- Hoseline, valves, and fittings couplings closed, flanges tight, valve packing glands tight, valves in operable position and closed. No sharp bends, proper lay on tank tops, sandbags on free ends and bends subject to whip, and the general condition of the hoseline.
- Sampling assembly in operable location, joints tight, valves closed, and grounding.
- Fire suppression equipment charged, ready to operate, and in proper location.
- Safety and no smoking signs readable and in proper location.
- Review pressure test results and evidence of corrective action.
- Road crossing protection (culverts and suspension devices) in place where needed.

- Range poles installed properly with cross cord at correct height.
- Corrective painting complete.
- Equipment identification marking correct and adequate.
- Portable fuel testing kit intact.
- Cleanup of area adequate.

Correct the faults found in the inspection and then reinspect. Do not proceed with the operations until all points affecting the integrity and safety of the system are corrected.

Section IV. Terminal Operations

OPERATIONS ORDER

Each terminal prepares its own operation order. It is based on the daily pumping order issued by the chief dispatcher. The daily pumping order is covered in Chapter 9. The contents and format of the terminal operation order are described below.

NOTE

With the introduction of JP-8 as the single fuel on the battlefield, batching and scheduling may not be needed in military pipelines and hoselines. However, for purposes of this manual, batching and scheduling procedures and fixed tankage will be discussed in the event multifuel pipelines are required or commercial facilities are operated by Army personnel. Motor gasoline and diesel fuel will also be discussed in the event commercial facilities are operated by Army personnel.

Contents.

The written operation should include the following for each operation:

- Specific personnel assigned to definite duties.
- Status of line fills and position of interfaces, if any exist.
- Valves, pumps, and tanks to be used.
- Estimated desired flow rates.
- Products and quantities of each product to be received or issued and the time operations are to begin.
- Desired pumping pressures to be maintained.
- Communications system to be used.
- Fire fighting equipment to have on hand.
- Location of the vessel, if applicable, and its estimated time of arrival; number and size of hoses and lines; and hose-handling equipment to be used.

- Any special instructions or precautions.

Format.

An operation order should include standard procedures, general orders, and special orders. These are discussed below.

- Standard procedures for commonly performed operations normally are prepared in advance. These operations include setting valves and selecting specific pumps.
- General orders include specific individual responsibilities by job assignment and the communications system to be used, including the telephone control system. Also, the general order should include the fire fighting equipment needed for the operation. The hose-handling equipment to be used and the number and size of hoses needed for the vessel should also be listed.
- Special orders should show the specific products, the amount of each product to be moved, where the products are to go, and the time to start and stop each operation. If a vessel or barge is involved in the operation and more than one berth is available, the orders should specify the berth to be used.

GENERAL OPERATING RULES AND PROCEDURES

Terminal design, product demands, and the nature of each receipt or issue of product determine specific operating procedures. However, there are certain rules and procedures that must be followed at any terminal for efficient operation and safety. They are described below.

Personnel Assignments and Training.

All personnel must be trained to know the entire system so that each person will be familiar with what the others are doing. Only experienced and qualified personnel should be assigned to independent work. Each person must receive complete operational instructions and must understand them. Personnel should be trained to anticipate emergencies so that they can cope with various situations.

Operating Rules.

There are general operating rules that must be followed. They are listed below.

- Product in each fixed tank must be sampled and gaged and each collapsible tank must be sampled before and after receipt. The quantities received or issued must be volume corrected according to AR 710-2. All of a dissimilar product must be flushed from common lines and the manifold with the same product being received or issued before an opening gage is taken. Sampling and gaging procedures in Chapter 3 must be followed. Quality surveillance procedures are covered in Military Handbook 200.
- Operations should be stopped and started slowly and carefully. Valves should be opened and closed slowly and pressures brought up gradually. Pressure gages should be watched so that working pressures are not exceeded.
- Tank vents must be checked for proper operation before product is pumped into or out of a tank. A stuck or clogged vent will cause pressure buildup in a tank. The only way to check the vent is to detect fume emission by smell or other means or to listen for vent clapping.
- During continuous pumping operations, the receiving tank should not be closed off until another tank is opened. If the pipeline is not in use, tank valves will normally be closed except where they need to be left open to relieve line pressure caused by thermoexpansion. All hatches on fixed tankage must be closed except when in use for gaging or sampling.
- There must be positive communications between personnel at operating points in the system at all times.

- Water bottoms must never be used in fixed tankage unless they are authorized by the proper technical authority. If water bottoms are authorized, they should be checked monthly for hydrogen sulfide. Hydrogen sulfide is corrosive and causes the product to fail the copper strip corrosion test.

- Except to switch tanks, no more than one tank must be open to a line system unless necessary.

- All tanks must be kept as full as practicable to avoid evaporation caused by high temperatures. Two tanks partially filled with the same product should be combined to make one full tank.

- Proper tools for each job must always be available. Keys must be available for locked valves and locked access pits.

- All safety precautions must be observed. Operations must be stopped when conditions become unsafe. Any unusual condition must be investigated before an operation is continued. If a tank starts to leak, its contents must be transferred to another tank at once and necessary precautions must be taken.

- A gate valve must never be forced closed. when a gate valve (rising or nonrising stem) is opened or closed, the wheel should be turned back at least one-quarter turn from the fully open or closed limit. This allows free wheel movement to show the valve is not stuck.

- Valves should always be double-checked to make sure the correct ones are opened or closed. Flow into or out of a tank must be verified as soon as possible after the start of an operation. Automatic tank gages must be read within 15 minutes of the start of the operation and periodically after that. Jet fuel tanks must not be gaged manually while they are being filled or emptied. Extreme caution must be used when tanks containing other products are gaged while they are being filled or emptied.

- All bulk petroleum working tanks are gaged daily. All nonworking tanks are gaged at least once a week.

Receipt of Product.

There are a number of general procedures that need to be followed when product is pumped into tanks. These procedures are described below.

- For fixed tankage, inspect the empty tanks before they receive the assigned product. If the tank is dirty, free it of vapor and have it cleaned. With all tanks, fixed and collapsible, drain any water collected in the bottom. If the fixed tank has a water bottom because of leaks, keep the water level below the tank inlet.

- As a general rule, receive into only one tank at a time.

- Watch the tank filling operation closely. For fixed tanks, take a rough gage on all tanks, except those receiving jet fuel, every hour to avoid overflows and report cumulative receipts. DO NOT take ullages, water soundings, temperatures, and samples on any tank receiving jet fuel until at least 20 minutes after pumping has stopped and flow has ceased. On collapsible tanks, watch the string line over the tank to determine when the tank is close to being filled.

- When the tank is nearly filled, open up another tank's valve to divert fuel flow and close off the full tank. As a general rule, leave 5 percent of the fixed tank capacity for vapor space. On collapsible tankage, the top of the tank should just touch the string line suspended over the tank. Use Appendix A as a guide for outages for different products at different temperatures.

- When pumping jet fuel into an empty fixed tank, limit the flow rate. Do not allow the flow rate through the loading line to exceed 3 feet per second until the inlet is covered by at least 3 feet of product. After that, resume the normal flow rate. When pumping gasoline or jet fuel into a vapor-free tank, limit the flow rate to one-fourth or one-fifth of the maximum flow rate until the inlet is covered by 3 feet of product.

- After product has had time to settle, drain any water from the tanks. Perform quality surveillance operations on the fuel.

Issue of Product.

The first in, first out policy (the issue of oldest stocks first) should be followed, and products should not be mixed. Follow the general procedures below for issuing fuel.

- Average issues seldom require more than one tank on- line at a time. When large issues are made from tanks with individual pumps, product may have to be issued from two or more tanks at a time to have the desired flow rate. When this is done, position an operator at each pump to regulate product flow.

- In some facilities, the operators may be able to remotely control individual tank pumps electronically at the tank, booster pump station, or delivery point. They can shut down pumps quickly in an emergency and operate the pumps without constantly being at each pump. However, an operator must be at each pump when gasoline or jet fuel is issued.

- Conduct quality surveillance according to Military Handbook 200.

Intraterminal Transfers

Product may be transferred between tanks in a terminal when the terminal is not receiving product from the main pipeline. Product may be circulated to end stratification. All free bottom water should be drawn off before such operations. Pipelines should be checked periodically during intraterminal transfers.

REMOVAL OF WATER FROM STORAGE TANKS

Water must be periodically removed from both fixed and collapsible storage tanks.

Remove water from fixed tanks as follows:

- Drain the water from jet fuel tanks after each product is received or daily. Test tanks for water with water-indicating paste each time a tank is gaged. Keep a record of the water checks.

- Drain water bottom from all tanks, except jet fuel tanks, the day after product is received or just before product is issued from the tanks.

- Check to see if there is water in tanks that have the water drawoff above the lowest point. If there is water, install an additional pump and a 3/7-inch water drawoff at the lowest point when the tank is opened for internal inspection.

- Drain the water slowly into tanks or tank vehicles approved for waste water disposal. Do not discharge tank farm drains into public sewers or waterways. Dispose of waste water in accordance with the local hazardous waste SOPs.

- Remove water from fuel tanks before it gets high enough to be drawn into the fuel outlet. For permanent facilities, a product recovery system should be installed to separate fuel and water mixtures.

LINE DISPLACEMENT

Lines should be kept filled with product. However, lines that are shutdown are sometimes drained to prevent pilferage or sabotage. Temperature changes, pressure loss, or air release may cause inaccurate issues or receipts. Therefore, lines must be filled or packed before each operation. Where there is a loop or double line system, lines may be filled by circulating product in them with or without booster pumps. A line may be filled by allowing air to escape through one or more vents at the high points and at the end of the line. This process is much slower, and it may leave air pockets in the line and cause gaging errors. However, this may be the only means available. Water may be used to displace product only if specifically

authorized by a technical authority. This process is used as a last resort because it is difficult to remove and dispose of the water completely.

PIPELINE METERS

Pipeline meters may reduce loss of product caused by leaks by allowing more reliable, continuous checks of pipelines. Also, they may reduce losses from terminal operations by providing a means of checking product receipts and deliveries. Meters may not stay accurate when they are in constant use. They should be verified periodically or when their accuracy is in doubt.

RECORDS AND REPORTS

DD Form 250 (Material Inspection and Receiving Report). DD Form 250 is a multipurpose form. It is used for reporting shipments and receipts of packaged petroleum and related products from contractors and government-owned or consigned pipeline deliveries. This form also is used to report shipments and receipts by tank vehicle and tank car from contractors. Instructions for preparing DD Form 250 are contained in DOD 4140.25-M.

DD Form 250-1 (Tanker/Barge Material Inspection and Receiving Report**).** DD Form 250-1 is used when bulk petroleum and related products are moved by tanker or barge. It is used mainly to report origin acceptance of the cargo, shipments and receipts of government-owned product, and destination acceptance of tanker and barge cargo. Instructions for preparing the form are in DOD 4140.25-M.

DA Form 5467-R (Petroleum Products Pipeline Leakage Report). DA Form 5467-R is used to report a leak found anywhere along the pipeline.

Class III Status Report**.** A Class III status report must be kept for each terminal in the pipeline system on a daily basis. Although there is no prescribed form for this report. The report shows the stock status of the terminal for the past 24 hours. It is sent to higher headquarters or to the chief dispatcher. File copies are kept at the terminal and at higher headquarters. These copies are a permanent record of terminal activities. They are part of the total record for the pipeline system. Minimum information needed in the report is as follows:

- Supply point number.
- Date.
- Report period.
- Receipts of product, by type, into the terminal.
- Total issues of product, by type, from the terminal.
- Total amount of product on hand, by type, in storage tanks, tank vehicles, barges, and packages at the end of the period.
- Total ullage available for specific products by tank designation at the end of the period.
- Information on unusable storage. (Location and causes of leaks, ruptures, or other damage; other reasons for unusable storage space; and anticipated changes in ullage due to maintenance are all reported.)
- Estimated requirements and issues, by type, for the next 24-hour period.

Daily Terminal Inventory Report.

The daily terminal inventory report is used only by coastal terminals that receive products by tanker. The report shows levels of marine terminal bulk fuel stock and permits tanker cargo adjustments before loading. Amounts are reported in thousands of barrels to the nearest hundred barrels (for example, 17.2).

The report is telephoned daily to the subarea petroleum office (SAPO). It gives the location of the terminal and the following information for each product:

- Military inventory in shore tankage.
- Commercial inventory in shore tankage allocated for military use.
- Usable inventory aboard floating storage.
- Days of supply on hand.
- Usable inventory in port tankers being discharged or awaiting discharge.

DA Form 4786 (Petroleum Products Tank Farm Intake Record)

DA Form 4786 is used to record the flow of petroleum products to the storage tank area from the dock area or other point of entry..

DA Form 5463-R (Petroleum Products Tank Farm Outturn Record).

DA Form 5463-R is used to record the flow of petroleum products from the storage tank area to tank cars, tank vehicles, and pipelines. It is used when shipments from the tank farm are consigned to outgoing vessels, tank cars, or tank vehicles. The form is also used if product is transferred from the dock area to the loading rack, bypassing terminal storage in emergencies.

Weekly Bulk Petroleum Terminal Message Report.

The bulk petroleum terminal message report (RCS:DLA(W)1884(DFSC-MIN)) is an operational report for Defense Fuel Supply Center (DFSC) commodity management and for tanker cargo scheduling review. The report is also used to answer inquiries from all levels of the federal government. Reports are prepared as of 0800 (local time) on Friday of each week. They are to arrive at DFSC no later than the following Monday. Information copies are sent to the proper joint petroleum office (JPO) and DFSC fuel region. Instructions for preparing the report are given in DOD 4140.25-M.

DD Form 1788 (Bulk Petroleum Terminal Report)

DD Form 1788 (RCS DLA(M)-1883 (DFSC)) is prepared by each terminal, terminal complex, or tanker serving as floating storage that has custody of products owned by the Defense Logistics Agency (DLA). Reports are prepared monthly. Instructions for preparing and forwarding the report are given in DOD 4140.25-M.

Annual Bulk Petroleum Storage Facilities Report

This report (RCS:DD-M(A)506) gives data on all bulk petroleum storage facilities of 500-barrel capacity or more, either singly or in manifold systems. The report, in a machine produced format, is provided annually by the DFSC. It is based on annual review and updates from the military departments and DFSC activities. All storage capacity changes, including product allocation changes, in excess of 10,000 barrels at any activity must be reported to the DFSC as changes occur. Instructions for preparing the report are given in DOD 4140.25-M

.

Section V. Maintenance

This manual covers lubrication, preventive maintenance, and corrective maintenance of the materials and equipment in a typical TPT. On major items of equipment, such as hoseline pumps, collapsible tanks, and filter separators, refer to the appropriate technical publication for detailed repair and maintenance procedures.

LUBRICATION PRACTICES

Mechanical equipment requires lubrication to overcome friction and minimize wear, damage, or corrosion. A firm lubrication procedure and schedule should be established. When the U.S. Army Lube

Order is available, lubricate equipment in accordance with the instructions in it. In this section, application of preservative compounds is included with lubrication where appropriate. Pivot points on various pieces of equipment should be lubricated regularly. Closure surfaces are lubricated to prevent corrosion. Unpainted surfaces should be coated with lubricant to prevent corrosion. Generally, if a part pivots, rotates, or slides and is subject to friction, it requires lubrication. Lubrication work can generally be handled in conjunction with the preventive maintenance program.

Table 6-1. Hose assemblies

Assemblies	Quantity	Length (ft)	Location	PSI 1/PSI 2	Notes
6-Inch Lightweight Collapsible Discharge Hose	96	250	Packed 2 to a flaking box	NA	The flaking box dimensions are 92 ¼ by 81 1/2 by 8 ¼ inches. The hose is used in the transfer hose assembly.
6-Inch Collapsible Discharge Hose	163	50	NA	150-1	These hose sections are used in the tank farm assemblies, contaminated fuel module, tank vehicle receipt manifold, fuel-dispensing assembly, and the switching manifold
6-Inch Noncollapsible Suction Hose	225	12	NA	100-2	These hose section are used in the tank farm assemblies and the tank vehicle receipt manifold.
7-Inch Collapsible Discharage Hose	13	12	NA	150-2	These hose sections are used in the contaminated fuel module and the optional tank configuration.
7-Inch Collapsible Dispensing Hose	4-6 or 4	25 or 50	NA	150-2	These hoses are used in the fuel-dispensing assembly and the 50,000-gallon TPT optional tank configuration

Table 6-1. Hose assemblies (continued)

Assemblies	Quantity	Length	Location	PSI 1/PSI 2	Notes
7-Inch Noncollapsible Suction Hose	90	12	NA	100-2	They are used in the vehicle receipt manifold, contaminated fuel module, and the 50,000-gallon TPT optional tank configuration.
1½-Inch Collapsible Dispensing Hose	6	25	NA	100-2	These hoses are used in the fuel-dispensing assembly.
6-Inch Double Groove Coupling Clamp	42	NA	25 clamps to a box	NA	These clamps are used with the 6-inch hoselines and the 6-inch fittings and valves. Each camp comes with a prelubricated gasket in its own plastic bag. Packed also are a hammer drift pin and two removable assembly tools. Although similar in appearance, these double-groove clamps and gaskets must not be confused with the IPDS and single-groove clamps supplied for the pipelines. They are not interchangeable. See Figure 6-14.
1-Inch Collapsible	4	25	NA	100-2	The meter skid assembly uses

Dispensing Hose					this hose for operation.
6-Inch Single-Groove Coupling Clamp	NA	NA	NA	NA	Used throughout TPTs if available. The single-groove clamps are compatible with double grooving. They fit into only the firs groove of the coupled components. The gasket is similar to that in the double-groove coupling; for example, prelubricated, synthetic rubber, and a C-shaped cross section. The gasket is compressed when the clamp is closed.
7-Inch Single-Groove Coupling Clamp	18	NA	NA	NA	The 7-inch single-groove coupling clamps have the same design characteristics as the 6-inch single-groove coupling clamp.

Table 6-2. Fitting and valve assemblies

Assemblies	Quantity	PSI 1/PSI 2	Notes
6-Inch Gate Valve Assembly	122	150-2	Gate valve assembly is a part of the tank farm assembly, contaminated fuel module, transfer hoseline assembly, tank vehicle receipt manifold, and the switching manifold.
6-Inch Double-Groove Ball Valve Assembly	13	NA	Values are a part of the fuel-dispensing assembly and the switching manifold.
7-Inch Quick-Disconnect T-Assembly	4	NA	1 male x 2 female—Two each. 3 male T—one each. 3 female T—one each. All gaskets and bolts are supplied with the Ts. These four 7-Inch T-assemblies are part of the 50,000-gallon TPT optional tank configuration.
7-Inch Quick-Disconnect Gate Valve Assembly	24	NA	These gate valves are part of the fuel-dispensing assembly and the 50,000-gallon TPT optional tank configuration.
7-Inch Quick-Disconnect Y-Assembly	NA	NA	Two version of this Y-assembly are in the TPT. There are three units of the two female and one male version and three units of the two male and one female version. This Y-assembly is a part of the 50-gallon optional tank configuration.
7-Inch Quick Disconnect Butterfly Valve Assembly	30	NA	The 7-Inch quick-disconnect butterfly valve is part of the fuel-dispensing assembly and the tank vehicle receipt manifold.
3-Inch Quick-Disconnect Ball Valve Assembly	1	NA	This ball valve assembly is in the contaminated fuel module.
1½ -Inch Quick Disconnect Ball Valve Assembly	12	NA	These ball valve assemblies are a part of the fuel-dispensing assembly.